

# PROCEDURE - CONVERSIONS THAT MAKE CENTS

1. Read through the background, paying particular attention to factors involved in a cost-benefit analysis.
2. List five factors used in a cost-benefit analysis of switching to an alternative fuel vehicle.

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3. Your teacher will place you in a group and assign one of the scenarios below. The scenarios are fictitious but are based on real situations. Click on your assigned scenario.

[The Florist](#)  
[The Bus Fleet](#)  
[The Plumber](#)  
[The Family](#)  
[The Private School](#)  
[The Foundation Repairer](#)

4. Read the scenario with your group and discuss any special needs or limitations identified.
5. Your group will now prepare to calculate the factors of replacing the vehicles in your scenario to compressed natural gas (CNG), propane, biodiesel and ultra-low-sulfur diesel. You will compare these to the costs of gasoline vehicles.

Click [here](#) for the first worksheet and print a copy.

- A. How many vehicles will need to be replaced? Check your scenario and enter that number by the "N" on your worksheet.
- B. How far will each vehicle travel each year? Check your scenario, calculate the correct number, and enter it by the "M" on your worksheet.
- C. How many miles per gallon does your vehicle get when running on gasoline? Check your scenario and enter the amount by the "G" on your worksheet.
- D. Read the scenario and the Vehicle Life Expectancy chart to identify the vehicle life expectancy. Enter this number by the "L"; then calculate the life span of your vehicles on your worksheet.

VEHICLE LIFE EXPECTANCIES	
Vehicle Type	Miles
Passenger sedan	100,000
Minivan	90,000
Full-size van	110,000
Med./heavy-duty truck	130,000
School bus	130,000

- E. Compare the incremental cost of buying an alternative-fueled vehicle to replace a vehicle that operates on gasoline in the chart below and record this information by the “E” on your worksheet.

Estimated AFV Costs Over Conventional Vehicle (\$)*					
Fuel Type	Passenger Sedan	Minivan	Full-Size Van	Medium-Duty Truck	School Bus
CNG	4,700	6,000	10,000	9,300	40,000
CNG/gasoline	5,000	500	500	9,300	9,200
Propane/gasoline	4,000	4,500	4,500	2,025	12,500
E85/gasoline	0	0	0	370	N/A
Biodiesel	0	0	0	0	0
Ultra-low-sulfur diesel	2,500	2,500	2,500	2,500	2,500

\* Purchase or conversion cost difference

- F. Go to [The Alternative Fuel Price Report](#). Click on the most current fuel report. Look for the current average costs of each fuel and record the appropriate number for each fuel next to “F” on your worksheet. Note: ultra-low-sulfur diesel costs approximately \$0.08/gallon more than conventional diesel.
6. You have now completed a table that compares several factors related to the cost of replacing a vehicle with an alternative fuel vehicle. You will use this comparison table to calculate the annual cost for vehicles using each fuel type. Click [here](#) to download and print a copy of the next worksheet.
7. For each fuel, plug your variables into the formula below and calculate. Note that for gasoline and ethanol you only have to calculate the fuel costs because extra equipment costs do not apply. Round figures up to two places past the decimal. Round the cost per year to the nearest dollar amount. Enter your calculations for each fuel on the second worksheet.

$$\left( \frac{N \times M}{G} \times F \right) + \frac{E \times N}{Y} = \text{Cost per year}$$

$$\frac{\text{number of vehicles} \times \text{mileage of vehicle per year}}{\text{conventional mpg}} \times \text{price per gallon equivalent} = \text{annual fuel costs}$$

$$\frac{\text{Extra equipment cost} \times \text{number of vehicles}}{\text{life span of each vehicle (years)}} = \text{amortized equipment costs}$$

$$\text{annual fuel costs} + \text{amortized equipment costs} = \text{cost per year}$$

10. After you have performed the calculations, answer the following questions:

- A. What are the least expensive and most expensive options in terms of fuel costs?

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B. What are the least expensive and most expensive options in terms of purchase price?

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C. When you factor in all the costs and savings, what is the least expensive alternative fuel vehicle for your scenario?

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D. Calculate and compare the cost of using the least expensive alternative fuel with the cost of continuing to use a conventional fuel. Is the alternative fuel more or less expensive?

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E. Are there any intangible benefits for the user in your scenario?

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F. Go to [http://www.eere.energy.gov/afdc/altfuel/fuel\\_properties.html](http://www.eere.energy.gov/afdc/altfuel/fuel_properties.html) to compare the environmental impacts of using the least expensive alternative fuel scenario to gasoline. In the first column, choose the least expensive fuel for your scenario and gasoline. In the second column, select "environmental impacts." What are the environmental impacts of using your selected alternative fuel versus gasoline?

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G. Go to [http://www.eere.energy.gov/afdc/altfuel/fuel\\_properties.html](http://www.eere.energy.gov/afdc/altfuel/fuel_properties.html) to compare the maintenance issues of using the least expensive alternative fuel scenario to gasoline. In the first column, choose the least expensive fuel for your scenario and gasoline. In the second column, select "maintenance issues." What are the maintenance issues for your selected alternative fuel versus gasoline?

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H. Go to [http://www.eere.energy.gov/afdc/altfuel/fuel\\_properties.html](http://www.eere.energy.gov/afdc/altfuel/fuel_properties.html) to compare the energy-security impacts of using the least expensive alternative fuel scenario to gasoline. In the first column, choose the least expensive fuel for your scenario and gasoline. In the second column, select "energy security impacts." What are the environmental impacts of using your selected alternative fuel versus gasoline?

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Maximum Federal Incentives/Rebates, 2006*		
Passenger Sedan	1,500	Clean Fuel Tax Deduction
Minivan	1,500	Clean Fuel Tax Deduction
Full-Size Van	3,750	Clean Fuel Tax Deduction
Medium-Duty Truck	3,750	Clean Fuel Tax Deduction
School Bus	2,500	ULSD only (Adopt-A-School Bus)
School Bus	30,000	Clean Fuel Tax Deduction

- I. Additional incentives or rebates are available on a state or regional level. To review federal or state incentives, go to the [U.S. Department of Energy web site](http://www.energy.gov) and read about the federal and state incentives to buyers of vehicles that meet stringent emissions standards. What are the incentives for the least expensive alternative fuel vehicle in your scenario?

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- J. How would these rebates and incentives affect the recommendation to the user in your scenarios?

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- K. What are some other factors not addressed in this scenario that might affect the costs and benefits?

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- L. As a group, what is the best recommendation to the user in your scenario?

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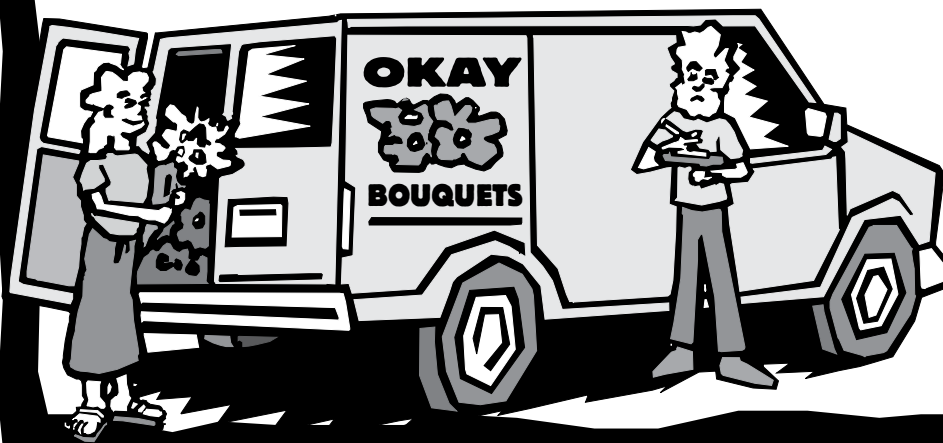


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11. Choose a spokesperson to review your scenario and conclusions for the class in a 3-5 minute presentation.

## THE FLORIST

Ian McShan owns a flourishing florist business in a moderate nonattainment area. He uses 20 five-year-old minivans for deliveries. As a nature lover, he feels compelled to investigate the use of alternative fuels for his business. He also thinks he may gain new customers if he "goes green." Each of his vans gets about 17 mpg on gasoline and travels about 350 miles a week or 18,200 miles per year.



## THE BUS FLEET

Jennifer Hu is the transportation director for a small school district in an industrial area of a severe nonattainment city. The district is required by law to choose an alternative fuel to power most of its vehicles by 2005. Ms. Hu wants to begin by replacing five of the district's 25 full-size school buses each year, starting this year. Each bus travels about 12,000 miles each school year, and a few are used on out-of-town trips. The buses are three years old and get about 6 mpg.



## THE PLUMBER

Eusebio Barrera owns a plumbing business in a serious nonattainment area. He has ten gasoline-powered vans that his employees drive about 13,000 miles a year each. The ten vans are seven years old. His sister Pilar, an accountant, wants him to investigate ways to qualify for tax breaks, and suggested looking into alternative fuels as a means of reducing costs. Barrera, who has several grandchildren, is also concerned about reducing ozone and carbon monoxide pollution. The full-size vans get about 13 mpg now.



## THE FAMILY

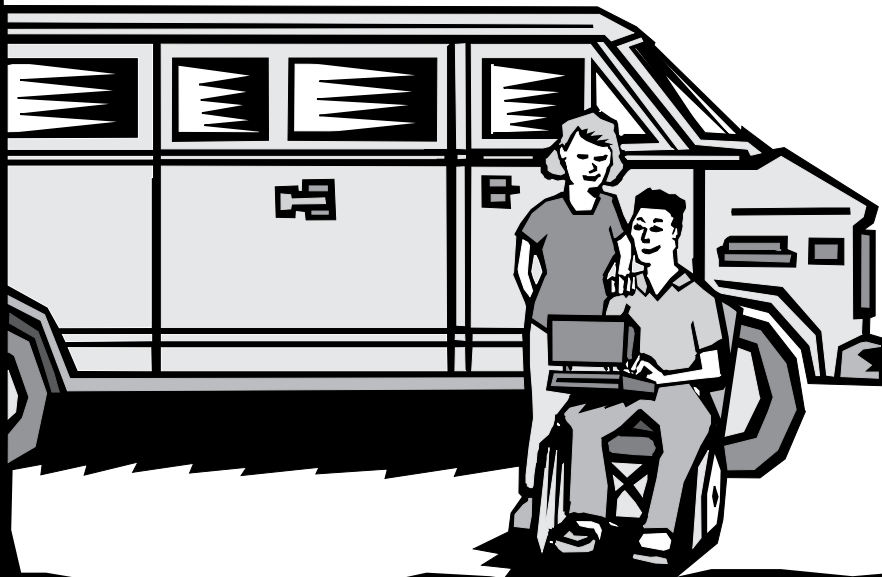
Lakeisha Washington is a teacher who has decided not to work outside the home for a few years to focus on caring for her young daughter. She and Gordon, her husband, are looking for ways to trim the family budget. As residents of a marginal nonattainment area, they also want to do their part for cleaner air—for themselves and for their child. Lakeisha drives a eight-year-old full-size passenger sedan about 15,000 miles a year, averaging about 32 mpg on gasoline. Gordon rides his 24-pound bicycle to work.





## THE PRIVATE SCHOOL

Cindy Petrovski and her husband, Thien Nguyen, are starting a private elementary school in a small town near a serious nonattainment area. They want to emphasize environmental and health issues in the curriculum, and the couple has decided to “practice what they teach.” Because the school will provide pick-up service for some students, they are considering switching to an alternative fuel for their full-size van. The couple estimates they will put 20,000 miles a year on their three-year-old van, which gets 10 mpg on gasoline.



## THE FOUNDATION REPAIRER

Martha Lacroix operates a foundation repair business in a severe nonattainment area. She is considering replacing two six-year-old medium-duty diesel trucks to alternative fuels during the next business year. Each of the trucks travels about 10,000 miles a year and gets 6 mpg. Lacroix's partner, Jim Dutton, is not receptive to the change. Lacroix plans to convince him with the "bottom line."



# STUDENT WORKSHEET #1

ENTER FROM SCENARIO OR CHARTS:

Variable	Symbol	Answer
Number of vehicles	N	
Mileage per vehicle per year	M	
Conventional mpg	G	
Vehicle life expectancies (miles)	L	
Life span of vehicle (L / M)(years)	Y	

SCENARIO NAME:

VEHICLE NAME:

TEAM MEMBERS:

Variable	Symbol	Gasoline	Biodiesel	CNG	CNG/ Gasoline
Extra equipment cost (\$)	E	0			
Price* (\$)	F				

Variable	Symbol	E85/ Gasoline	M85/ Gasoline	Propane	Propane/ Gasoline
Extra equipment cost (\$)	E				
Price* (\$)	F				

ENTER CORRECT GENERIC FORMULA:

\*Price of fuels in gasoline gallon equivalent (price per 114,250 Btu)  
Source: U.S. D.O.E., Alternative Fuel Price Report, 10/9/00

# STUDENT WORKSHEET #2

Scenario Name: \_\_\_\_\_

Apply generic formula for each fuel

Type of Fuel: _____
= \$ _____ per year

Type of Fuel: _____
= \$ _____ per year

Type of Fuel: _____
= \$ _____ per year

Type of Fuel: _____
= \$ _____ per year

Type of Fuel: _____
= \$ _____ per year

Type of Fuel: _____
= \$ _____ per year